

REVISED

NOISE ELEMENT OF THE GENERAL PLAN

MAMMOTH LAKES, CALIFORNIA

INSTITUTE OF GOVERNMENT
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TABLE OF CONTENTS

CHAPTER ONE	1
INTRODUCTION	1
1.1 Purpose and Scope	1
1.2 Relationship to Other Elements of the General Plan	2
1.3 Noise and Its Effects On People	3
1.4 Definitions.....	3
CHAPTER TWO	5
EXISTING AND FUTURE NOISE ENVIRONMENT	5
2.1 Overview of Sources.....	5
2.2 Methods Used to Develop Noise Exposure Information	5
2.3 Roadways.....	7
2.4 Snow Removal	10
2.5 Snow Making	10
2.6 Business/Industrial Site Near Meridian Boulevard and Commerce Drive.....	11
2.7 Avalanche Control Noise Impacts	11
2.8 Helicopter Noise Impacts.....	16
2.9 Mammoth/June Lakes Airport	17
CHAPTER THREE	19
COMMUNITY NOISE SURVEY	19
3.1 Community Noise Survey.....	19
CHAPTER FOUR.....	27
GOALS AND POLICIES	27
4.1 Goals	27
4.2 Policies.....	27
CHAPTER FIVE	29
IMPLEMENTATION MEASURES	29

APPENDICES

- A. NOISE AND ITS EFFECTS ON PEOPLE
- B. REQUIREMENTS FOR AN ACOUSTICAL ANALYSIS

TABLE OF CONTENTS

1. Introduction	1
2. Objectives	2
3. Scope	3
4. Methodology	4
5. Results	5
6. Discussion	6
7. Conclusion	7
8. References	8
9. Appendix	9
10. Glossary	10
11. Bibliography	11
12. Index	12
13. Acknowledgements	13
14. Executive Summary	14
15. Abstract	15
16. Introduction	16
17. Objectives	17
18. Scope	18
19. Methodology	19
20. Results	20
21. Discussion	21
22. Conclusion	22
23. References	23
24. Appendix	24
25. Glossary	25
26. Bibliography	26
27. Index	27
28. Acknowledgements	28
29. Executive Summary	29
30. Abstract	30
31. Introduction	31
32. Objectives	32
33. Scope	33
34. Methodology	34
35. Results	35
36. Discussion	36
37. Conclusion	37
38. References	38
39. Appendix	39
40. Glossary	40
41. Bibliography	41
42. Index	42
43. Acknowledgements	43
44. Executive Summary	44
45. Abstract	45
46. Introduction	46
47. Objectives	47
48. Scope	48
49. Methodology	49
50. Results	50
51. Discussion	51
52. Conclusion	52
53. References	53
54. Appendix	54
55. Glossary	55
56. Bibliography	56
57. Index	57
58. Acknowledgements	58
59. Executive Summary	59
60. Abstract	60
61. Introduction	61
62. Objectives	62
63. Scope	63
64. Methodology	64
65. Results	65
66. Discussion	66
67. Conclusion	67
68. References	68
69. Appendix	69
70. Glossary	70
71. Bibliography	71
72. Index	72
73. Acknowledgements	73
74. Executive Summary	74
75. Abstract	75
76. Introduction	76
77. Objectives	77
78. Scope	78
79. Methodology	79
80. Results	80
81. Discussion	81
82. Conclusion	82
83. References	83
84. Appendix	84
85. Glossary	85
86. Bibliography	86
87. Index	87
88. Acknowledgements	88
89. Executive Summary	89
90. Abstract	90
91. Introduction	91
92. Objectives	92
93. Scope	93
94. Methodology	94
95. Results	95
96. Discussion	96
97. Conclusion	97
98. References	98
99. Appendix	99
100. Glossary	100
101. Bibliography	101
102. Index	102
103. Acknowledgements	103
104. Executive Summary	104
105. Abstract	105
106. Introduction	106
107. Objectives	107
108. Scope	108
109. Methodology	109
110. Results	110
111. Discussion	111
112. Conclusion	112
113. References	113
114. Appendix	114
115. Glossary	115
116. Bibliography	116
117. Index	117
118. Acknowledgements	118
119. Executive Summary	119
120. Abstract	120
121. Introduction	121
122. Objectives	122
123. Scope	123
124. Methodology	124
125. Results	125
126. Discussion	126
127. Conclusion	127
128. References	128
129. Appendix	129
130. Glossary	130
131. Bibliography	131
132. Index	132
133. Acknowledgements	133
134. Executive Summary	134
135. Abstract	135
136. Introduction	136
137. Objectives	137
138. Scope	138
139. Methodology	139
140. Results	140
141. Discussion	141
142. Conclusion	142
143. References	143
144. Appendix	144
145. Glossary	145
146. Bibliography	146
147. Index	147
148. Acknowledgements	148
149. Executive Summary	149
150. Abstract	150
151. Introduction	151
152. Objectives	152
153. Scope	153
154. Methodology	154
155. Results	155
156. Discussion	156
157. Conclusion	157
158. References	158
159. Appendix	159
160. Glossary	160
161. Bibliography	161
162. Index	162
163. Acknowledgements	163
164. Executive Summary	164
165. Abstract	165
166. Introduction	166
167. Objectives	167
168. Scope	168
169. Methodology	169
170. Results	170
171. Discussion	171
172. Conclusion	172
173. References	173
174. Appendix	174
175. Glossary	175
176. Bibliography	176
177. Index	177
178. Acknowledgements	178
179. Executive Summary	179
180. Abstract	180
181. Introduction	181
182. Objectives	182
183. Scope	183
184. Methodology	184
185. Results	185
186. Discussion	186
187. Conclusion	187
188. References	188
189. Appendix	189
190. Glossary	190
191. Bibliography	191
192. Index	192
193. Acknowledgements	193
194. Executive Summary	194
195. Abstract	195
196. Introduction	196
197. Objectives	197
198. Scope	198
199. Methodology	199
200. Results	200
201. Discussion	201
202. Conclusion	202
203. References	203
204. Appendix	204
205. Glossary	205
206. Bibliography	206
207. Index	207
208. Acknowledgements	208
209. Executive Summary	209
210. Abstract	210
211. Introduction	211
212. Objectives	212
213. Scope	213
214. Methodology	214
215. Results	215
216. Discussion	216
217. Conclusion	217
218. References	218
219. Appendix	219
220. Glossary	220
221. Bibliography	221
222. Index	222
223. Acknowledgements	223
224. Executive Summary	224
225. Abstract	225
226. Introduction	226
227. Objectives	227
228. Scope	228
229. Methodology	229
230. Results	230
231. Discussion	231
232. Conclusion	232
233. References	233
234. Appendix	234
235. Glossary	235
236. Bibliography	236
237. Index	237
238. Acknowledgements	238
239. Executive Summary	239
240. Abstract	240
241. Introduction	241
242. Objectives	242
243. Scope	243
244. Methodology	244
245. Results	245
246. Discussion	246
247. Conclusion	247
248. References	248
249. Appendix	249
250. Glossary	250
251. Bibliography	251
252. Index	252
253. Acknowledgements	253
254. Executive Summary	254
255. Abstract	255
256. Introduction	256
257. Objectives	257
258. Scope	258
259. Methodology	259
260. Results	260
261. Discussion	261
262. Conclusion	262
263. References	263
264. Appendix	264
265. Glossary	265
266. Bibliography	266
267. Index	267
268. Acknowledgements	268
269. Executive Summary	269
270. Abstract	270
271. Introduction	271
272. Objectives	272
273. Scope	273
274. Methodology	274
275. Results	275
276. Discussion	276
277. Conclusion	277
278. References	278
279. Appendix	279
280. Glossary	280
281. Bibliography	281
282. Index	282
283. Acknowledgements	283
284. Executive Summary	284
285. Abstract	285
286. Introduction	286
287. Objectives	287
288. Scope	288
289. Methodology	289
290. Results	290
291. Discussion	291
292. Conclusion	292
293. References	293
294. Appendix	294
295. Glossary	295
296. Bibliography	296
297. Index	297
298. Acknowledgements	298
299. Executive Summary	299
300. Abstract	300
301. Introduction	301
302. Objectives	302
303. Scope	303
304. Methodology	304
305. Results	305
306. Discussion	306
307. Conclusion	307
308. References	308
309. Appendix	309
310. Glossary	310
311. Bibliography	311
312. Index	312
313. Acknowledgements	313
314. Executive Summary	314
315. Abstract	315
316. Introduction	316
317. Objectives	317
318. Scope	318
319. Methodology	319
320. Results	320
321. Discussion	321
322. Conclusion	322
323. References	323
324. Appendix	324
325. Glossary	325
326. Bibliography	326
327. Index	327
328. Acknowledgements	328
329. Executive Summary	329
330. Abstract	330
331. Introduction	331
332. Objectives	332
333. Scope	333
334. Methodology	334
335. Results	335
336. Discussion	336
337. Conclusion	337
338. References	338
339. Appendix	339
340. Glossary	340
341. Bibliography	341
342. Index	342
343. Acknowledgements	343
344. Executive Summary	344
345. Abstract	345
346. Introduction	346
347. Objectives	347
348. Scope	348
349. Methodology	349
350. Results	350
351. Discussion	351
352. Conclusion	352
353. References	353
354. Appendix	354
355. Glossary	355
356. Bibliography	356
357. Index	357
358. Acknowledgements	358
359. Executive Summary	359
360. Abstract	360
361. Introduction	361
362. Objectives	362
363. Scope	363
364. Methodology	364
365. Results	365
366. Discussion	366
367. Conclusion	367
368. References	368
369. Appendix	369
370. Glossary	370
371. Bibliography	371
372. Index	372
373. Acknowledgements	373
374. Executive Summary	374
375. Abstract	375
376. Introduction	376
377. Objectives	377
378. Scope	378
379. Methodology	379
380. Results	380
381. Discussion	381
382. Conclusion	382
383. References	383
384. Appendix	384
385. Glossary	385
386. Bibliography	386
387. Index	387
388. Acknowledgements	388
389. Executive Summary	389
390. Abstract	390
391. Introduction	391
392. Objectives	392
393. Scope	393
394. Methodology	394
395. Results	395
396. Discussion	396
397. Conclusion	397
398. References	398
399. Appendix	399
400. Glossary	400
401. Bibliography	401
402. Index	402
403. Acknowledgements	403
404. Executive Summary	404
405. Abstract	405
406. Introduction	406
407. Objectives	407
408. Scope	408
409. Methodology	409
410. Results	410
411. Discussion	411
412. Conclusion	412
413. References	413
414. Appendix	414
415. Glossary	415
416. Bibliography	416
417. Index	417
418. Acknowledgements	418
419. Executive Summary	419
420. Abstract	420
421. Introduction	421
422. Objectives	422
423. Scope	423
424. Methodology	424
425. Results	425
426. Discussion	426
427. Conclusion	427
428. References	428
429. Appendix	429
430. Glossary	430
431. Bibliography	431
432. Index	432
433. Acknowledgements	433
434. Executive Summary	434
435. Abstract	435
436. Introduction	436
437. Objectives	437
438. Scope	438
439. Methodology	439
440. Results	440
441. Discussion	441
442. Conclusion	442
443. References	443
444. Appendix	444
445. Glossary	445
446. Bibliography	446
447. Index	447
448. Acknowledgements	448
449. Executive Summary	449
450. Abstract	450
451. Introduction	451
452. Objectives	452
453. Scope	453
454. Methodology	454
455. Results	455
456. Discussion	456
457. Conclusion	457
458. References	458
459. Appendix	459
460. Glossary	460
461. Bibliography	461
462. Index	462
463. Acknowledgements	463
464. Executive Summary	464
465. Abstract	465
466. Introduction	466
467. Objectives	467
468. Scope	468
469. Methodology	469
470. Results	470
471. Discussion	471
472. Conclusion	472
473. References	473
474. Appendix	474
475. Glossary	475
476. Bibliography	476
477. Index	477
478. Acknowledgements	478
479. Executive Summary	479
480. Abstract	480
481. Introduction	481
482. Objectives	482
483. Scope	483
484. Methodology	484
485. Results	485
486. Discussion	486
487. Conclusion	487
488. References	488
489. Appendix	489
490. Glossary	490
491. Bibliography	491
492. Index	492
493. Acknowledgements	493
494. Executive Summary	494
495. Abstract	495
496. Introduction	496
497. Objectives	497
498. Scope	498
499. Methodology	499
500. Results	500
501. Discussion	501
502. Conclusion	502
503. References	503
504. Appendix	504
505. Glossary	505
506. Bibliography	506
507. Index	507
508. Acknowledgements	508
509. Executive Summary	509
510. Abstract	510
511. Introduction	511
512. Objectives	512
513. Scope	513
514. Methodology	514
515. Results	515
516. Discussion	516
517. Conclusion	517
518. References	518
519. Appendix	519
520. Glossary	520
521. Bibliography	521
522. Index	522
523. Acknowledgements	523
524. Executive Summary	524
525. Abstract	525
526. Introduction	526
527. Objectives	527
528. Scope	528
529. Methodology	529
530. Results	530
531. Discussion	531
532. Conclusion	532
533. References	533
534. Appendix	534
535. Glossary	535
536. Bibliography	536
537. Index	537
538. Acknowledgements	538
539. Executive Summary	539
540. Abstract	540
541. Introduction	541
542. Objectives	542
543. Scope	543
544. Methodology	544
545. Results	545
546. Discussion	546
547. Conclusion	547
548. References	548
549. Appendix	549
550. Glossary	550
551. Bibliography	551
552. Index	552
553. Acknowledgements	553
554. Executive Summary	554
555. Abstract	555
556. Introduction	556
557. Objectives	557
558. Scope	

LIST OF FIGURES

Figures

1	Location of Major Noise Sources	6
2	Comparison of Energy Average (L_{eq}) Sound Levels at 323 Wagon Wheel	12
3	Noise Measurement Locations For Avalanche Control Gun and Community Noise Survey	14
4	Aircraft CNEL Contours: Worst-Case Scenario	18
5-10	Background Noise Levels, Hourly Variations, 107 Sugar Pine, 394 Grindelwald and 323 Wagon Wheel	20-25

LIST OF TABLES

Tables

I	Distance to L_{dn} Contours and Traffic Data.....	9
II	Summary of Noise Levels from Town of Mammoth Lakes Snow Removal Equipment.....	10
III	Summary of Muzzle Blast and Shell Detonation Noise Levels from Gun No. 2.....	15
IV	Range of A-Weighted and C-Weighted Day/Night Average Levels at at Test Locations in the Town of Mammoth Lakes Avalanche Control Gun No. 2.....	16
V	Representative Noise Levels of Medical Helicopters Measured at Nearby Residential Areas	17
VI	Summary of Community Noise Survey Results	26
VII	Maximum Allowable Noise Exposure-Stationary Noise Sources	28

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REFERENCES

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CHAPTER ONE

INTRODUCTION

1.1 Purpose and Scope

The Noise Element of the General Plan is a planning document which provides a policy framework for addressing potential noise impacts encountered in the planning process.

The content of a Noise Element and the methods used in its preparation have been determined by the requirements of Section 65302 (f) of the California Government Code and by the *State of California General Plan Guidelines* published by the California Office of Planning and Research in 1990. The Guidelines require that major noise sources and areas containing noise-sensitive land uses be identified and quantified by preparing generalized noise exposure contours for current and projected conditions.

According to the Government Code requirements, noise exposure information should be included in a Noise Element for the following major noise sources:

1. Highways and freeways
2. Primary arterials and major local streets
3. Railroad operations
4. Aircraft and airport operations
5. Local industrial facilities
6. Other stationary sources

Noise-sensitive uses identified by the Government Code and by the Town of Mammoth Lakes include the following:

1. Residential development
2. Schools
3. Hospitals, nursing homes
4. Churches

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5. Libraries

The Noise Element is directed at minimizing future noise conflicts. A noise ordinance, on the other hand, is directed at resolving existing noise conflicts. A noise ordinance may be used to address noise levels generated by existing industrial and residential uses, which are not regulated by federal or state noise level standards. The regulation of noise sources such as traffic on public roadways, railroad line operations and aircraft in flight is preempted by existing federal and/or state regulations, meaning that such sources generally may not be addressed by a noise ordinance. The Noise Element addresses the prevention of noise conflicts from all of these sources.

1.2 Relationship to Other Elements of the General Plan

The Noise Element is related to the Land Use, Housing, Circulation and Open Space Elements of the General Plan. Recognition of the interrelationship of noise and these four mandated elements is necessary to prepare an integrated general plan and to initiate changes which will reduce noise exposure to acceptable levels in areas where noise may presently exceed the levels set forth by the adopted policies of the Noise Element. The relationship between these elements is briefly discussed below:

1. Land Use: An objective of the Noise Element is to provide noise exposure information for use in the Land Use Element. When integrated with the Noise Element, the Land Use Element will show acceptable land uses in relation to existing and projected noise levels.
2. Housing: The Housing Element considers the provision of adequate sites for new housing and standards for housing stock. Since residential land uses are noise-sensitive, the noise exposure information of the Noise Element must be considered when planning the locations of new housing. The State Noise Insulation Standards may influence the locations and construction costs of multi-family dwellings, which should be considered by the Housing Element.
3. Circulation: The circulation system, which is a major source of noise, must be correlated with the Land Use Element. This is especially true for roadways which carry significant numbers of trucks. Noise exposure will thus be a decisive factor in

The first part of the paper is devoted to a general discussion of the problem. It is shown that the problem is of great importance for the theory of the structure of the universe. The second part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is of great importance for the theory of the structure of the universe. The third part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is of great importance for the theory of the structure of the universe.

2. The problem of the structure of the universe

The problem of the structure of the universe is one of the most important problems in the theory of the structure of the universe. It is shown that the problem is of great importance for the theory of the structure of the universe. The first part of the paper is devoted to a general discussion of the problem. It is shown that the problem is of great importance for the theory of the structure of the universe. The second part of the paper is devoted to a detailed analysis of the problem. It is shown that the problem is of great importance for the theory of the structure of the universe.

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the location and design of new transportation facilities, and in the mitigation of noise produced by existing facilities upon existing and planned land uses.

4. Open Space: Excessive noise adversely affects the enjoyment of recreational pursuits in designated open space, particularly in areas where quiet is a valued part of the recreational experience. Thus, noise exposure should be considered in planning for this kind of open space use. Conversely, open space can be used to buffer noise-sensitive uses from noise sources by providing setbacks and visual screening.

1.3 Noise And Its Effects On People

Appendix A provides a discussion of the fundamentals of noise assessment, the effects of noise on people and criteria for acceptable noise exposure, and is a reference for use by the Town during the review of documents or proposals which refer to the measurement and effects of noise.

1.4 Definitions

1. A-Weighted Sound Level (dBA): Except as specified, all sound levels referred to in this policy document are in *A-weighted* decibels. A-weighting de-emphasizes the very low and very high frequencies of sound in a manner similar to the human ear. Most community noise standards utilize A-weighting, as it provides a high degree of correlation with human annoyance and health effects.
2. Community Noise Equivalent Level (CNEL): The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.
3. C-Weighted Day/Night Average Sound Level (L_{Cdn}): The average equivalent sound level during a 24-hour day, obtained after addition of ten *C-weighted* decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.
4. C-Weighted Sound Level (dBC): C-weighting is essentially flat in response except in very low and very high frequencies. C-weighting is often used to judge human response to sonic booms, blasting and artillery fire.

It is a very common mistake to think that the only way to get a good result is to use a lot of force.

But this is not true. In fact, the best results are often achieved with a light touch.

For example, when you are working on a piece of wood, it is better to use a light touch than a heavy one.

Why? Because a light touch allows you to feel the wood better and to work it more easily.

On the other hand, a heavy touch can make it difficult to feel the wood and to work it properly.

So, when you are working on a piece of wood, it is important to use a light touch.

This will help you to get a good result.

2. The importance of the touch

The touch is one of the most important factors in the work of the craftsman.

It is the touch that allows the craftsman to feel the material he is working on.

And it is the touch that allows him to work the material in the best way possible.

So,

3. The importance of the eye

The eye is another important factor in the work of the craftsman.

It is the eye that allows the craftsman to see the material he is working on.

And it is the eye that allows him to see the result of his work.

So, when you are working on a piece of wood, it is important to use your eye.

This will help you to get a good result.

The eye is also important in the work of the artist.

It is the eye that allows the artist to see the colors and the shapes of the things he is painting.

And it is the eye that allows him to see the result of his work.

So,

The eye is also important in the work of the scientist.

It is the eye that allows the scientist to see the things he is studying.

And it is the eye that allows him to see the result of his work.

So,

The eye is also important in the work of the teacher.

It is the eye that allows the teacher to see the things he is teaching.

And it is the eye that allows him to see the result of his work.

5. Day/Night Average Sound Level (L_{dn}): The average equivalent sound level during a 24-hour day, obtained after addition of ten *A-weighted* decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.
6. Equivalent Sound Level (L_{eq}): The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.
7. Maximum Sound Level (L_{max}): The maximum sound level recorded during a noise event.
8. New Development: Projects requiring land use approval or building permits, but excluding remodelling or additions to existing structures.
9. Noise-Sensitive Land Use: Residential land uses, transient lodging, schools, libraries, churches, hospitals and nursing homes.
10. Outdoor Activity Areas: Patios, decks, balconies, outdoor eating areas, swimming pool areas, yards of dwellings and other areas which have been designated for outdoor activities and recreation.
11. Stationary Noise Source: Any fixed or mobile source not preempted from local control by existing federal or state regulations. Examples of such sources include industrial and commercial facilities, and vehicle movements on private property.
12. Transportation Noise Source: Traffic on public roadways, railroad line operations and aircraft in flight. Control of noise from these sources is preempted by existing federal or state regulations. However, the effects of noise from transportation sources may be controlled by regulating the location and design of adjacent land uses.

The first of these is the fact that the average age of the population is increasing. This is due to a number of factors, including a decline in the birth rate and an increase in life expectancy.

The second factor is the increasing number of people living in urban areas. This is due to a number of factors, including a decline in the birth rate and an increase in life expectancy.

The third factor is the increasing number of people living in urban areas. This is due to a number of factors, including a decline in the birth rate and an increase in life expectancy.

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The eighth factor is the increasing number of people living in urban areas. This is due to a number of factors, including a decline in the birth rate and an increase in life expectancy.

The ninth factor is the increasing number of people living in urban areas. This is due to a number of factors, including a decline in the birth rate and an increase in life expectancy.

CHAPTER TWO

EXISTING AND FUTURE NOISE ENVIRONMENT

2.1 Overview of Sources

Based on discussions with Town staff, the requirements of the Government Code and field studies conducted during the preparation of this document, it was determined that the following noise sources should be addressed in the Noise Element:

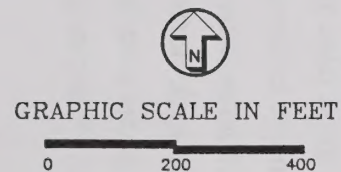
- Traffic on State Route 203 and Major Town Roadways
- Aircraft Operations at Mammoth/June Lakes Airport
- Helicopter Operations at Mammoth Hospital
- Snowmaking Operations
- Snow Removal Activities
- Avalanche Control
- Industrial Activities near State Route 203 and Meridian Boulevard

Figure 1 shows the locations of some of these sources.

2.2 Methods Used to Develop Noise Exposure Information

According to the Government Code and General Plan Guidelines, noise exposure contours should be developed in terms of the Day-Night Average Level (L_{dn}) or Community Noise Equivalent Level (CNEL). Both of these descriptors represent the weighted energy noise level for a 24-hour day after including a 10 dB penalty for noise levels occurring at night between the hours of 10:00 p.m. and 7:00 a.m. The CNEL descriptor additionally includes a penalty of about 5 dB for noise levels occurring during the evening hours of 7:00 p.m. and 10:00 p.m. The CNEL descriptor was developed to quantify aircraft noise, and its use is required when preparing noise exposure maps for airports within the State of California. The CNEL and L_{dn} descriptors are generally considered to be equivalent to each other for most community noise environments within ± 1.0 dB. The L_{dn} descriptor has been used in this Noise Element to quantify noise from the above-described major noise sources.

LOCATION OF MAJOR NOISE SOURCES TOWN OF MAMMOTH LAKES



■ MAJOR NOISE SOURCES

BBA



OFFICE OF THE
ATTORNEY GENERAL
STATE OF NEW YORK

APR 1968

To supplement the L_{dn} noise descriptor, the hourly L_{eq} and L_{max} descriptors have been used to characterize noise levels from stationary noise sources that are addressed in this Noise Element. Because many stationary noise sources operate sporadically, the hourly L_{eq} and L_{max} are more useful for predicting noise conflicts from such sources than is the L_{dn} . The L_{dn} , by definition, is a modified average noise exposure over 24 hours. If a noise source operates only a few hours a day, averaging the noise over 24 hours may under-estimate its nuisance potential. Since the L_{dn} descriptor is required by the Government Code for Noise Elements, noise exposure from stationary noise sources also has been described using this descriptor.

Analytical noise modeling techniques were used to develop generalized noise contours for existing and future conditions. Analytical noise modeling techniques generally use source-specific data, including descriptions of noise-generating equipment or activities, hours of operation, seasonal fluctuations, and average levels of noise from source operations. Analytical methods have been developed for many environmental noise sources, including roadways, railroad line operations, railroad yard operations, industrial plants and aircraft/airport operations. Such methods will produce reliable results as long as data inputs and assumptions are valid for the sources being studied.

The noise exposure information developed during the preparation of the Noise Element does not include all conceivable sources of industrial or commercial noise within the Town of Mammoth Lakes, but rather focuses on the existing sources of noise which have been identified by the Town as being significant. As the policies of this Noise Element are applied in the future, it is likely that other potentially significant sources will be identified.

2.3 Roadways

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used to develop L_{dn} contours for State Route 203 and major Town roadways. The FHWA Model is the analytical method currently favored by most state and local agencies, including Caltrans, for highway traffic noise prediction. The model is based upon reference energy emission levels for automobiles, medium trucks (2 axles) and heavy trucks (3 or more axles), with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA Model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is generally considered to be accurate within ± 1.5 dB. The model assumes a clear view of traffic with no shielding at the

In the summer of 1901, when the weather was very hot, I went to the beach. The water was very warm, and the sand was very hot. I went to the beach every day, and I was very happy. I was very happy because I was very young, and I was very healthy. I was very happy because I was very young, and I was very healthy. I was very happy because I was very young, and I was very healthy.

The water was very warm, and the sand was very hot. I went to the beach every day, and I was very happy. I was very happy because I was very young, and I was very healthy. I was very happy because I was very young, and I was very healthy. I was very happy because I was very young, and I was very healthy.

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receiver location. To predict L_{dn} values, it is necessary to determine the hourly distribution of traffic for a typical day and adjust the traffic volume input data to yield an equivalent hourly traffic volume. The Calvenno traffic noise emission curves were used as recommended by Caltrans to more accurately calculate noise levels generated by California traffic.

Existing (1994) and future (2009) traffic volumes used to calculate traffic noise levels were based on the traffic study performed by Robert Kahn, John Kain & Associates, Inc.¹ The winter weekend daily volumes from Reference 1 were adjusted by 60%² to more accurately reflect annual average conditions. Truck volumes were estimated by the Town. The Day/Night distribution of traffic was based on assumptions used by BBA for comparable streets, since these data were unavailable from any other source. Vehicle speeds assumed during the traffic noise modelling process were the posted vehicle speeds.

Table I lists the distances of the existing and future 60 and 65 dB L_{dn} contours from roadway centers, along with input data used in the FHWA Model. Maps on file with the Town of Mammoth Lakes show the approximate location of the contours. Note that contour distances less than 50 feet are not shown on the maps.

¹ Robert Kahn, John Kain & Associates, Inc., *Mammoth Transportation Model Final Report, Town of Mammoth Lakes, California*, April 13, 1995.

² Telephone conversation with William Taylor, Mammoth Lakes Planning Department, on September 15, 1995.

**BLE I
DISTANCE TO L_{dn} CONTOURS AND TRAFFIC DATA
TOWN OF MAMMOTH LAKES**

							Distance to L _{dn} Contours (Ft.) ¹			
		AADT					1994		2009	
Roadway	1994	2009	%D/N ²	%MT ³	%HT ⁴	Speed (MPH)	65 dB	60 dB	65 dB	60 dB
Route 203:										
Meridian-Sierra Park	3,600	8,500	90/10	2.5	2.5	45	36	77	63	136
Sierra Park-Lake Mary	9,700	13,400	90/10	2.5	2.5	35	49	105	60	130
Lake Mary-Hillside	3,500	12,400	90/10	2.5	2.5	30	23	49	53	114
Hillside-Main Lodge	4,300	5,600	90/10	2.5	2.5	35	28	61	34	73
Lake Mary Road:										
Main-Davison	4,100	5,600	90/10	1	2	35	25	53	31	66
Davison-Crystal Crag	1,100	1,600	90/10	1	2	35	10	22	13	29
Minaret Road:										
Lake Mary-Meridian	3,000	15,400	90/10	.5	1	40	22	46	64	138
Meridian-Old Mammoth	1,700	10,000	90/10	.5	1	35	12	26	39	83
South of Old Mammoth	---	3,800	90/10	.5	1	35	--	--	20	44
Meridian Boulevard:										
Route 203-Old Mammoth	1,000	4,000	90/10	1	2	45	14	30	35	76
Old Mammoth-Minaret	3,400	9,100	90/10	.5	1	40	23	50	45	97
Minaret-Majestic Pines	2,300	6,700	90/10	.5	1	40	18	39	37	79
Old Mammoth Road:										
Route 203-Meridian	6,900	9,700	90/10	.5	2	30	31	68	39	85
Meridian-Sherwin Creek	5,600	6,700	90/10	.5	2	30	27	59	31	66
Sherwin Creek-Ski Trail	2,600	4,300	90/10	.5	2	40	22	47	31	66
¹ Distances from roadways centers ² Day/Night traffic split (day=10 a.m.-7 p.m.; night=10 p.m.-7 a.m.) ³ Medium Trucks ⁴ Heavy Trucks										
Sources: Reference 1 Brown-Buntin Associates, Inc.										

2.4 Snow Removal

Snow removal is performed by the Town of Mammoth Lakes on city streets and by individuals on private property. During the winter, snow removal on city streets can occur 24 hours per day. The Town operates four loaders with blades, three loaders with blower attachments, one road grader with blade, and two plow/cinder trucks. Table II summarizes noise levels from some of this equipment measured under actual operating conditions with chains.

TABLE II
SUMMARY OF NOISE LEVELS FROM
TOWN OF MAMMOTH LAKES SNOW REMOVAL EQUIPMENT

Equipment	Distance	Position/Operation	dBA	
			Range	L _{eq}
966D	100'	Behind	76-77	76.5
966D	100'	Behind-Under Load	78-80	78.6
966D	100'	Passby-Full Load	68-77	74.0
950F	100'	Passby w/Back-up Bells	69-87	80.7
950F	100'	Bells Only	76-78	---
950F	100'	Engine Only	74-75	---
950F	100'	Blade Dragging	81-85	---

Source: Brown-Buntin Associates, Inc.

2.5 Snow Making

According to Mr. Dennis Agee, Planning Director for Mammoth Mountain Ski Area, snow making equipment is located near Warming Hut II at the west end of Canyon Boulevard is proposed for the base of Chair 15 at the west end of Meridian Boulevard. Snow making may occur during the day or night depending on weather conditions.

During the night, the SMI Silentstorm Snowmaker is used, which is an airless type of snow maker. Airless snow makers are reported to produce lower noise levels than typical snow making systems that expel air and water through a nozzle at high pressure. During the day, typical air/water equipment may be used. Up to 10 snow making guns may operate simultaneously.

Based on measurements conducted by BBA of many air/water snow makers, noise levels at 50 feet from the side of nozzles ranged from about 81 to 94 dBA. At the same distance from the side of the SMI Silentstorm Snowmaker, the level measured by BBA was 71 dBA.

2.6 Business/Industrial Site Near Meridian Boulevard and Commerce Drive

This facility includes the Town equipment yard, Mammoth Disposal, an asphalt batch plant and concrete batch plant. Sound level measurements were conducted at 323 Wagon Wheel, which represents a typical residential site adjacent to the industrial area. Figure 2 shows hourly sound level measurements at this site during April and July 1995. The sound levels measured in April were during a stormy and windy period and therefore do not represent sound levels from the business/industrial park. From July 25-27, 1995, however, the weather was calm and the levels shown in Figure 2 fairly represent the total noise environment, including activities at the business/industrial site. The July hourly levels are generally under 45 dBA, L_{eq} which would satisfy most land use compatibility criteria.

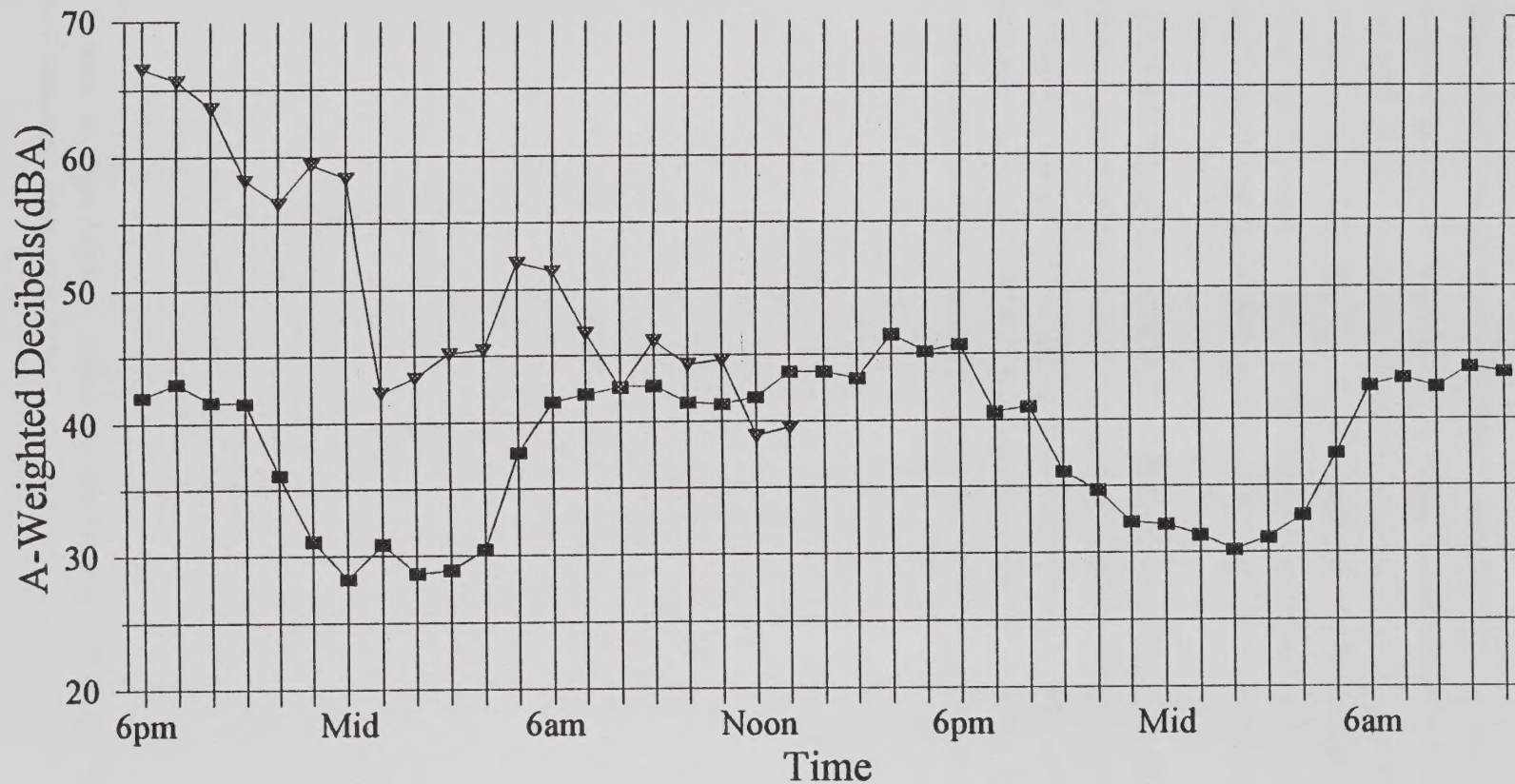
2.7 Avalanche Control Noise Impacts

Mammoth Mountain Ski Area and the U.S. Forest Service uses various explosive devices to break-up excessive snow accumulations that may create avalanches near ski slopes in the Mammoth Mountain area. Hand-thrown explosive charges and explosive shells propelled by 106 m.m. recoilless rifles are mainly used for this purpose. During a season of heavy snow accumulation, such as 1994-95, about 1700 hand charges and 800 propelled charges may be used. Avalanche control is normally done from about 6:00 a.m. to 8:30 a.m., before the ski lifts are in operation. Three gun sites are located in the Mammoth ski area. Gun #2, that is located on the south slope of Lincoln Mountain and fires shells into the north side of Mammoth Mountain and the Dragon's Back, is responsible for most of the audible cannon fire in the Town of Mammoth Lakes. Guns #1 and #3 are situated so that their muzzle blasts and shell detonations are not as noticeable in the community.

Test firings of Gun #2 were conducted on May 30, 1995 from about 7:00 a.m.-8:00 a.m. The temperature was about 40°-50°F in the Town of Mammoth Lakes, with no wind and a clear sky. Three locations were selected in the community that represent sites where worst-case noise exposure would be expected due to proximity and almost unobstructed line-of-

Figure 2

Comparison of Energy Average(Leq) Sound Levels at 323 Wagon Wheel
Adjacent to Business/Industrial Site



—■— July 25-27, 1995 —▼— April 29-30, 1995

100

100 / 100 = 100%



sight to the gun and target area. These locations are south of Lake Mary Road and are shown in Figure 3. Results of test firings are shown in Table III.

North of Lake Mary Road, muzzle blasts and shell detonations from Gun #2 are generally shielded from residences by Lincoln Mountain. However, explosions from hand-thrown charges along the north and east slopes of Lincoln Mountain and near Lake Mary Road are reportedly quite noticeable in this area. Hand charges are also used by the Tamarack avalanche control crew. Although more hand charges are used for avalanche control than gun firings, it is believed that individual noise impacts from hand charges are not as severe as those from gun firings.

From the data in the Table III and the estimated number of shells fired per day in the avalanche season, it is possible to calculate the noise level in terms of the Day/Night Average Level (L_{dn}) using A-weighted decibels and the Day/Night Average Level using C-weighted decibels (L_{Cdn}). C-weighted decibels and the L_{Cdn} descriptor are often used by the military to characterize the annoyance from high-energy impulsive noise, such as sonic booms and artillery fire³.

³American National Standards Institute, *Methods of Assessment of High-Energy Impulsive Sounds with Respect to Residential Communities, Appendix A, 1986.*

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GRAPHIC SCALE IN FEET



FIGURE 3
NOISE MEASUREMENT LOCATIONS FOR
AVALANCHE CONTROL GUN AND COMMUNITY NOISE SURVEY

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TABLE III
SUMMARY OF MUZZLE BLAST AND SHELL
DETONATION NOISE LEVELS FROM GUN NO. 2
MAY 30, 1995

Location	Decibels		
	Unwtd. Peak	L _{max} (A-Wtd., Fast Response)	SEL (A-Wtd, Fast Response)
W. End of Meridian			
Shot No. 1			
Muzzle	---	58	67
Shell	110	71	
Shot No. 2			
Muzzle	---	58	70
Shell	106	77	
Shot No. 3			
Muzzle	---	53	73
Shell	114	79	
Log Mean	111		71
Fire Station on Old Mammoth Rd.			
Shot No. 1			
Muzzle	---	63	70
Shell	107	67	
Shot No. 2			
Muzzle	---	54	72
Shell	112	78	
Shot No. 3			
Muzzle	---	54	64
Shell	103	68	
Log Mean	109		70
Red Fir Rd.			
Shot No. 1			
Muzzle	---	64	63
Shell	106	63	
Shot No. 2			
Muzzle	---	61	64
Shell	104	66	
Shot No. 3			
Muzzle	---	71	71
Shell	103	---	
Log Mean	105		68

Notes: - Shot No. #1 was in Mammoth Mountain; Shot No. 2 was in the middle of the Dragon's Back; and Shot No. #3 was in the tail of the Dragon's Back.

- SEL values include sound energy from both the muzzle blast and shell detonation.

Source: Brown-Buntin Associates, Inc.

STATE OF NEW YORK
IN SENATE
JANUARY 10, 1911

RECEIPTS			TOTAL
DEPARTMENT	MONTH	AMOUNT	
TREASURY	Jan	100	100
	Feb	150	250
	Mar	200	450
	Apr	180	630
	May	170	800
Total			700
EDUCATION	Jan	50	50
	Feb	75	125
	Mar	100	225
	Apr	125	350
	May	150	500
Total			250
AGRICULTURE	Jan	25	25
	Feb	37	62
	Mar	50	112
	Apr	62	174
	May	75	249
Total			123
NAVY	Jan	10	10
	Feb	15	25
	Mar	20	45
	Apr	25	70
	May	30	100
Total			50
MILITARY	Jan	15	15
	Feb	22	37
	Mar	30	67
	Apr	37	104
	May	45	149
Total			78
Total			1150

The following table shows the amount of money received by the State of New York during the month of January, 1911, from the various sources mentioned in the foregoing table.

The total amount received by the State of New York during the month of January, 1911, was \$1,150.

Based on Forest Service estimates, about 20-30 shells per day may be discharged from Gun #2 during the avalanche season. Assuming half of the shells are fired before 7:00 a.m., the L_{dn} and L_{Cdn} values were calculated at the three test locations noted above. Table IV lists the calculated values.

TABLE IV
RANGE OF A-WEIGHTED AND C-WEIGHTED DAY/NIGHT AVERAGE LEVELS
AT TEST LOCATIONS IN THE TOWN OF MAMMOTH LAKES
AVALANCHE CONTROL GUN NO. 2

Location	Day/Night Average Level, dB	
	A-weighted (L_{dn})	C-weighted (L_{Cdn})
W. End of Meridian	42-44	56-58
Fire Station on Old Mammoth Rd.	41-43	54-56
Red Fir Rd.	39-41	50-52
Source: Brown-Buntin Associates, Inc.		

From Table IV, it can be seen that L_{Cdn} values ranged from about 50-58 dB. According to research sponsored by the National Research Council⁴, between 3 and 9 percent of the populace can be expected to be highly annoyed by L_{Cdn} values ranging from 50 to 58 dB.

2.8 Helicopter Noise Impacts

Helicopters are occasionally used to transport patients to the Mammoth Hospital. The severity of noise impacts due to the helicopters depends on their frequency of use, the time of day or night when flights occur, the types of helicopter used, and whether helicopters fly near noise-sensitive uses when approaching and leaving the hospital. The FAA requires that the Day/Night Average Level (L_{dn}) be used to describe land use compatibility with respect to helicopter noise exposure.

⁴Committee on Hearing, Bioacoustics and Biomechanics, WG84, *Assessment of Community Response to High-Energy Impulsive Sounds*, National Research Council, 1981.

Additionally, the FAA recommends that the subjective impact of helicopter noise impacts may be determined by comparing Sound Exposure Levels (SEL's) of helicopter flights to background noise levels at residential areas (The SEL measures the total sound energy of a single helicopter passby). More helicopter flights are allowed when background noise levels are high, according to the FAA's recommendations.

Table V lists helicopter SEL's measured by BBA during other studies at residential locations near hospitals. The residences generally were within a 1-mile radius of the hospital. The SEL's in Table V should not be construed as those that would necessarily occur at residential areas near Mammoth Hospital.

TABLE V REPRESENTATIVE NOISE LEVELS OF MEDICAL HELICOPTERS MEASURED AT NEARBY RESIDENTIAL AREAS		
Hospital	Helicopter	SEL, dB
Clovis Community Hospital, Clovis	Fairchild-Hiller FH-110	81-89
Kern Medical Center, Bakersfield	Aerospatiale AS-350B	83-86
Kern Medical Center, Bakersfield	A-Star 350B	83-99
UCLA Medical Center, Westwood	Augusta A-109	74-92
UCLA Medical Center, Westwood	Bell 205	72-90
UCLA Medical Center, Westwood	BK-117	81-96
Source: Brown-Buntin Associates, Inc.		

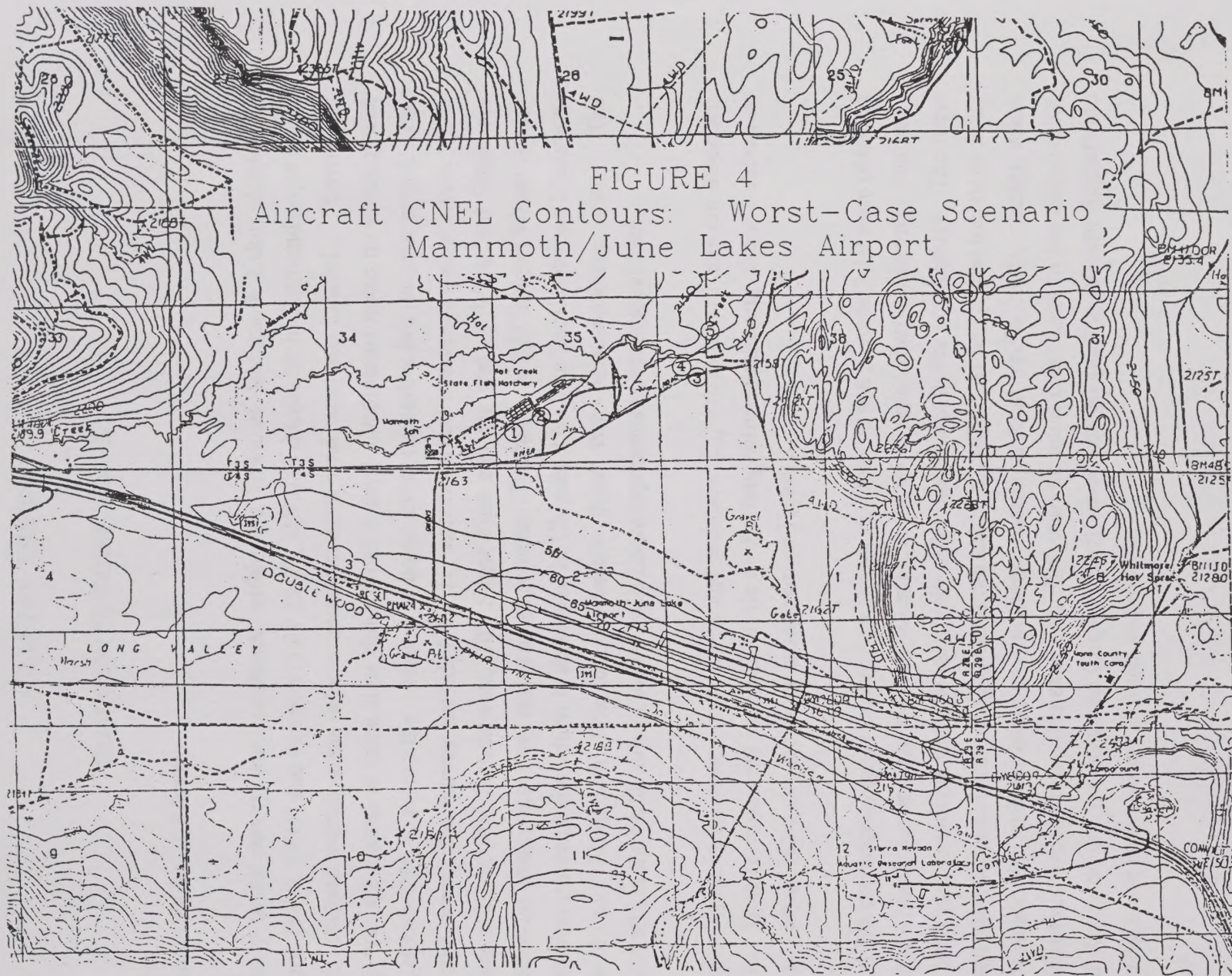
2.9 Mammoth/June Lakes Airport

Figure 4 shows CNEL contours for Mammoth/June Lake Airport. The scenario shown represents Year 2015 conditions, including the use of Boeing 737 and 757 aircraft. This scenario represents worst-case conditions around the airport.

The contours were prepared in January, 1995 for Reinhard W. Brandley, Consulting Airport Engineer using Version 4.11 of the Integrated Noise Model (INM). The INM is the standard aircraft noise prediction model, and is the method preferred by Caltrans Division of Aeronautics

and the Federal Aviation Administration (FAA) for land use compatibility planning. The operations data used in the model were provided by Reinhard W. Brandley.

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-55- CNEL CONTOUR

EXISTING
TOPOGRAPHY

SCENARIO No. 4
2015 OPERATIONS WITH
EXTENDED RUNWAY 9-27
AIRLINE - 8737 & 8757

NOISE CONTOURS DEVELOPED
BROWN - JUMTIN ASSOC.
JANUARY 1989

MONO COUNTY

MAMMOTH LAKES AIRPORT

AIRCRAFT CNEL CONTOURS

Reinard W. Brandley

DATE FEB 1 19

SHEET 1

CHAPTER THREE

COMMUNITY NOISE SURVEY

3.1 Community Noise Survey

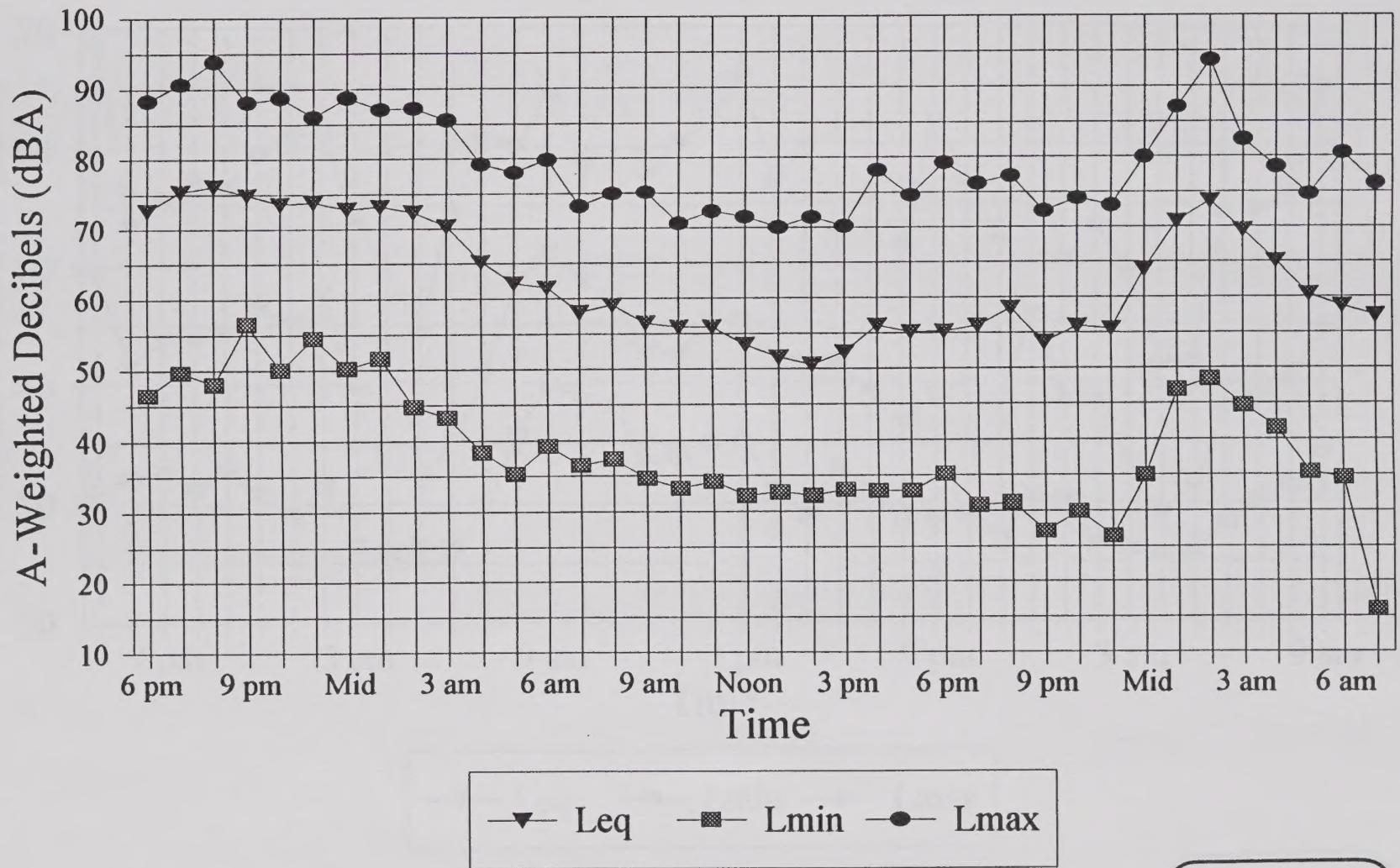
A community noise survey was conducted within the Town of Mammoth Lakes during the winter (April 29-30, 1995) and summer (July 25-27, 1995) to document background noise levels in different seasons within areas where noise-sensitive land uses are located. Short-term monitoring was conducted at three sites three times a day. Continuous noise monitoring was conducted at two sites to record the variation of noise levels through a full 24-hour period. The data collected during the survey included the L_{eq} and observed maximum noise levels. The measurement sites at 319 Grindelwald, 107 Sugar Pine and the end of Waterford Street are typical residential areas away from major noise sources. The house at 323 Wagon Wheel is near the industrial/commercial site which is described in Chapter 2.6. The knoll between Mammoth High School and Mammoth Hospital represents these two noise-sensitive uses. The measurement site at the south side of lower Twin Lakes represents a recreational area.

Noise monitoring sites, measured noise levels and estimated L_{dn} values at each site are described in Table VI. Hourly variations in noise levels at the long-term monitoring site are shown in Figures 5-10. Monitoring site locations are shown on Figure 3.

The April, 1995 community noise survey data shown in Table VI and Figures 5-10 were obtained during windy conditions and are more representative of wind noise than community sources. The July, 1995 measurements indicate relatively quiet conditions in the community. The most common and significant noise source in Mammoth Lakes is traffic. At residential locations away from major roads, the residual noise environment consists of local traffic, birds, running water and miscellaneous sounds from domestic use. To preserve quiet conditions in the community, noise level standards and policies (see Chapter Four) have been adopted to prevent degradation of the existing noise environment as much as possible.

Figure 5

Background Noise Environment 107 Sugar Pine, April 29-May 1, 1995

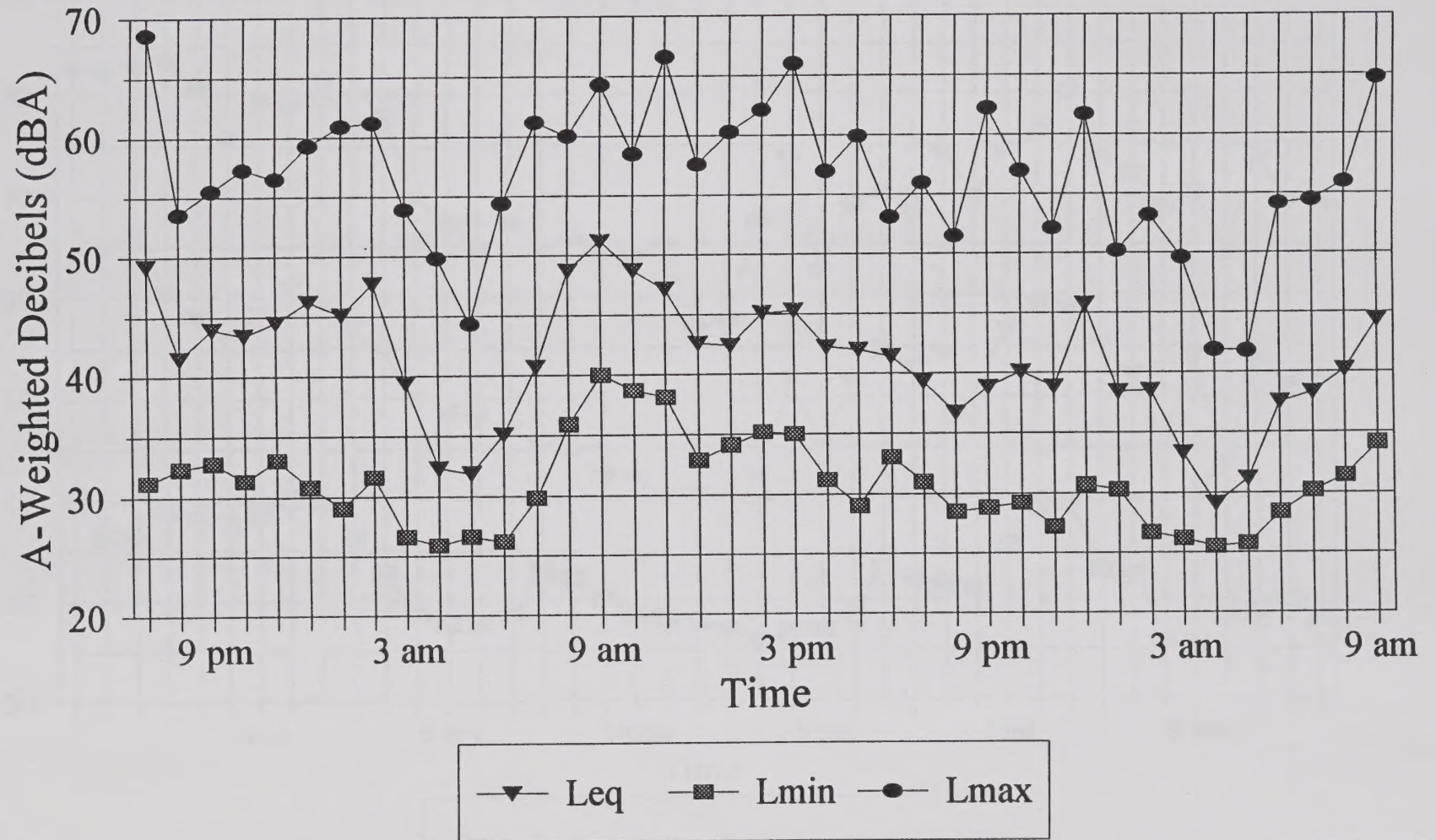


BBA



Figure 6

Background Noise Environment 107 Sugar Pine, July 25-27, 1995



BBA

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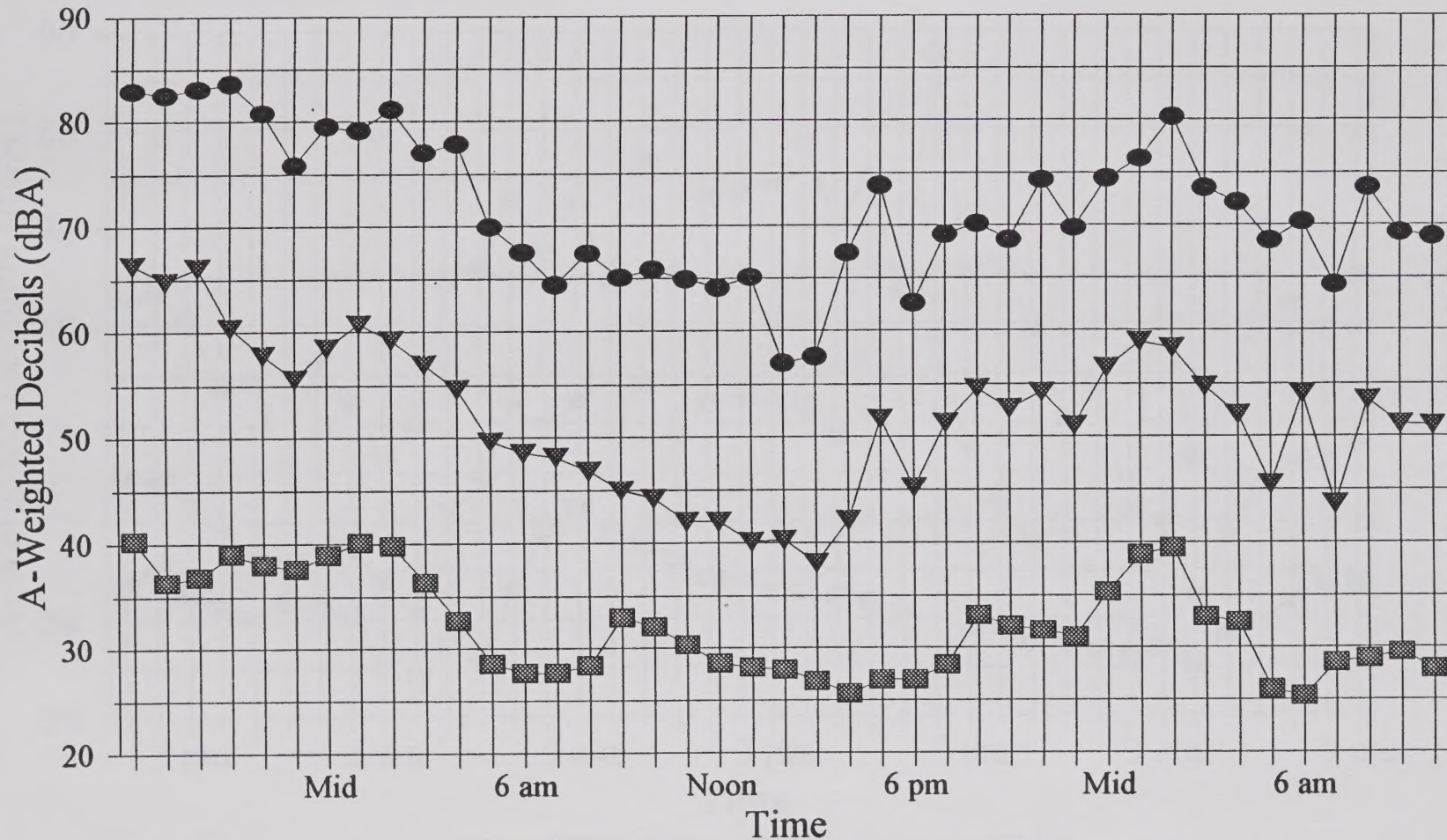
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Figure 7

Background Noise Environment 394 Grindelwald, April 29-May 1, 1995

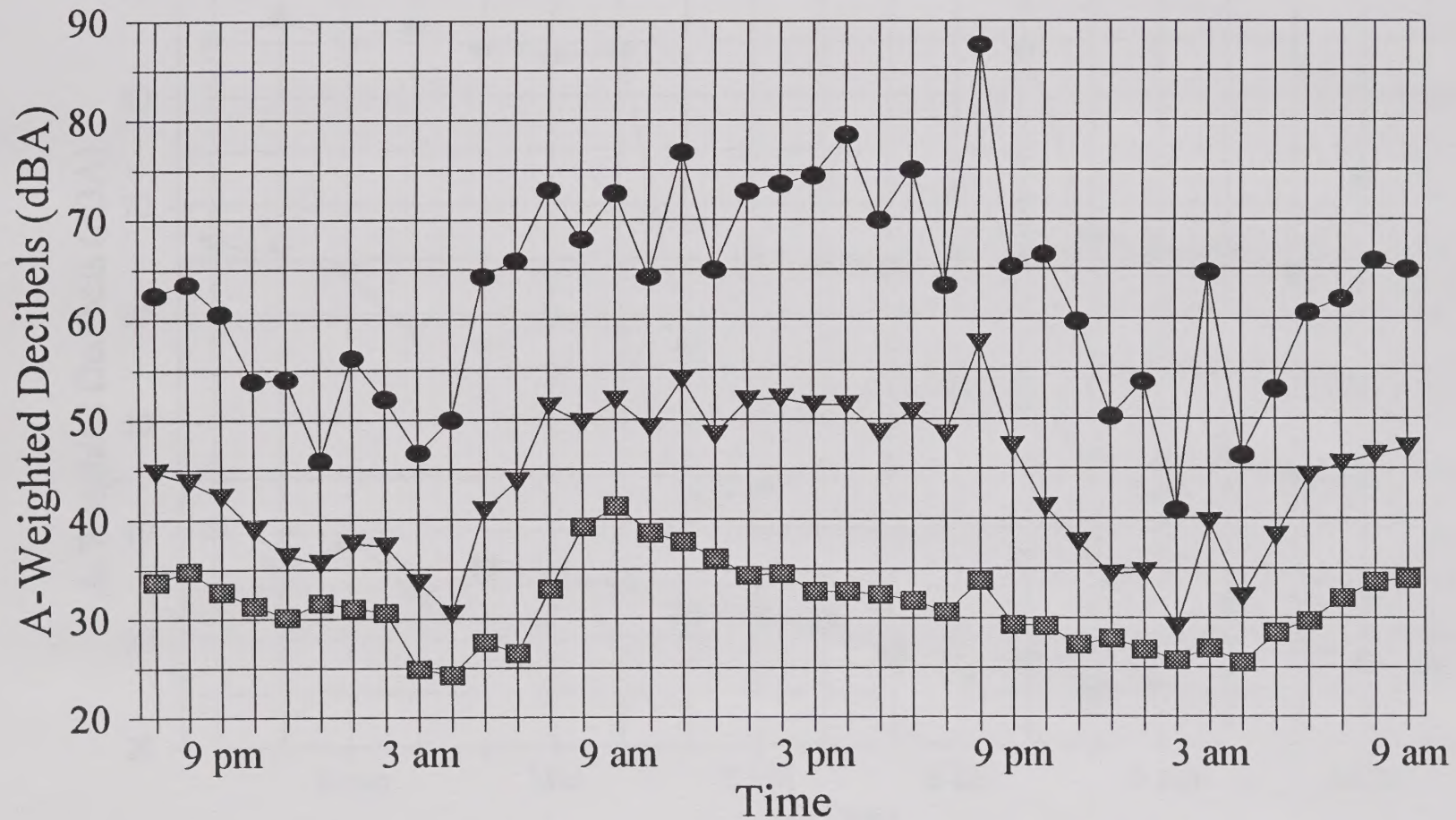


—▼— Leq —■— Lmin —●— Lmax

BBA

Figure 8

Background Noise Environment 394 Grindelwald, July 25-27, 1995



—▼— Leq —■— Lmin —●— Lmax

BBA

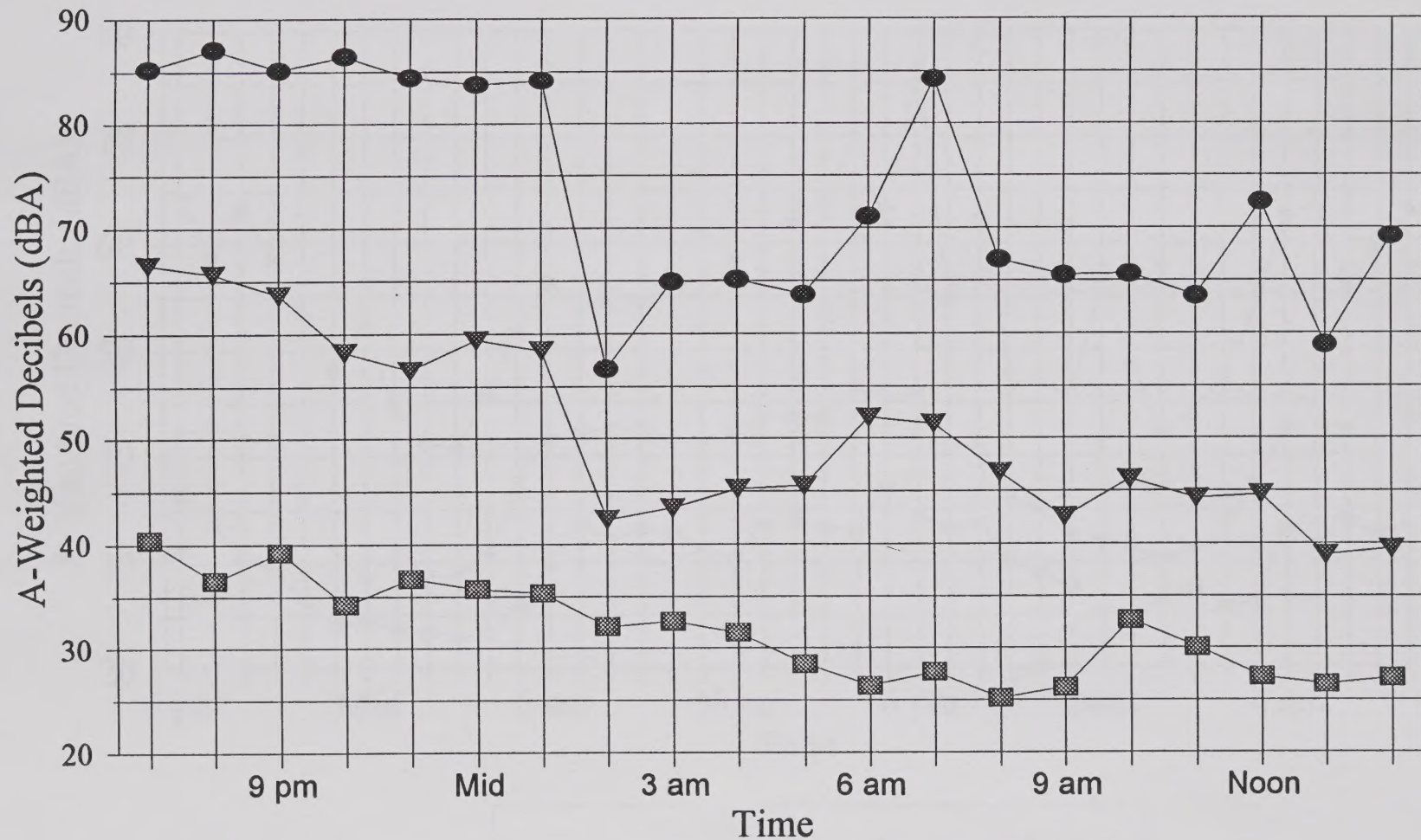
THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

Figure 9

Background Noise Environment 323 Wagon Wheel, April 29-30, 1995

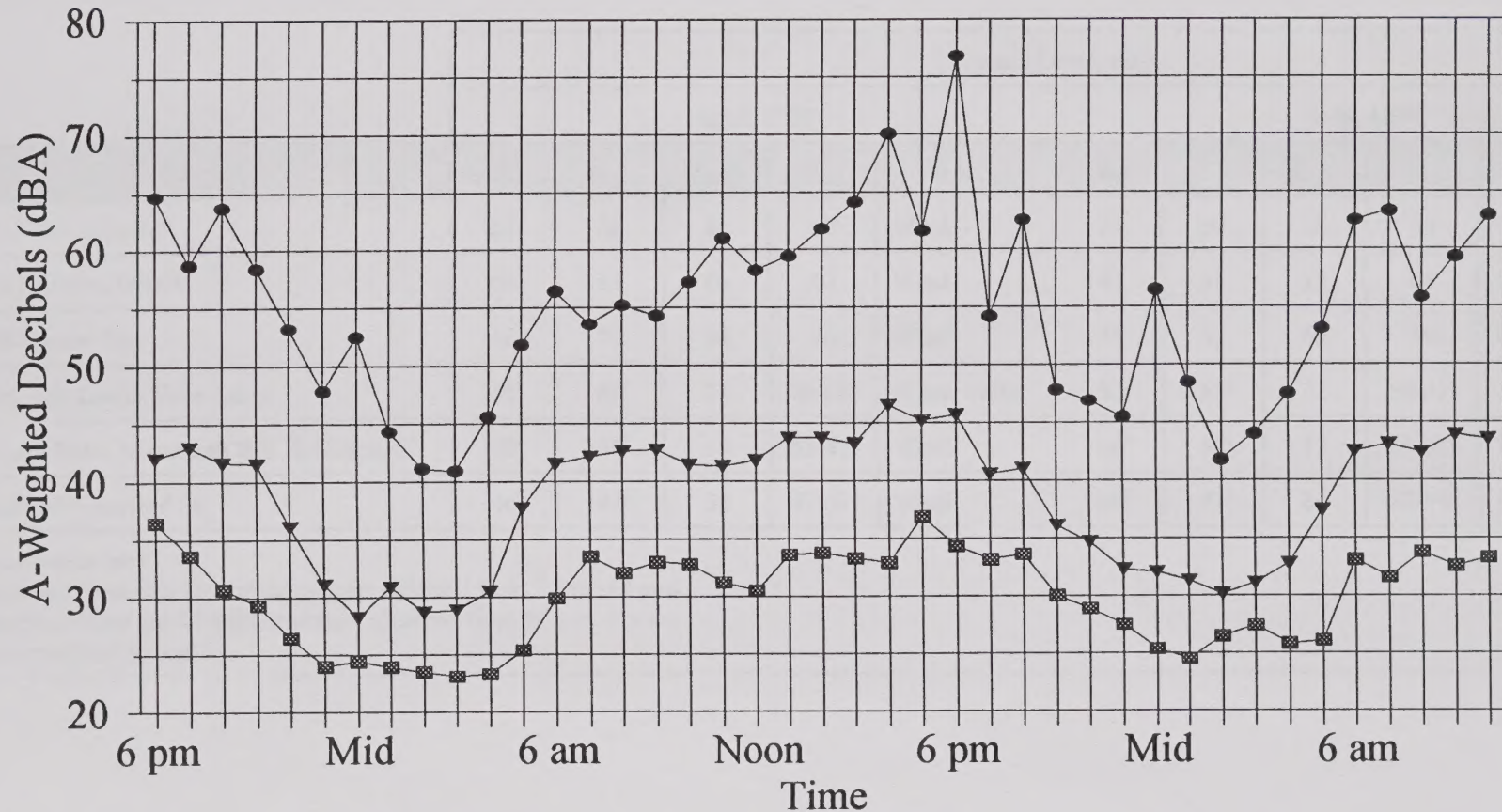


—▼— Leq —■— Lmin —●— Lmax

BBA

Figure 10

Background Noise Environment 323 Wagon Wheel, July 25-27, 1995



—▼— Leq —■— Lmin —●— Lmax

BBA

TABLE VI
SUMMARY OF COMMUNITY NOISE SURVEY RESULTS
TOWN OF MAMMOTH LAKES

		Sound Level, dBA									
		April, 1995					July, 1995				
Site No.	Location	L _D	L _N	L _{max}	L _{dn}	Sources	L _D	L _N	L _{max}	L _{dn}	Sources
1	319 Grindelwald ¹	57	56	84	63	Wind	51	39	78	50	Unknown
2	323 Wagon Wheel ¹	60	55	86	63	Wind	43	35	77	44	Unknown
3	107 Sugar Pine ¹	68	70	94	76	Wind	46	43	69	50	Unknown
4	So. side Lower Twin Lakes	50 ²	60 ³	62	64-68 ⁴	Wind, traffic	53 ²	52 ³	72	57-61 ⁴	Traffic, water
5	Knoll Betw. Mammoth H.S. & Hospital	50 ²	48 ³	65	53-57 ⁴	Wind	60 ²	50 ³	59	58-62 ⁴	Traffic
6	End of Waterford St.	46 ²	42 ³	58	47-51 ⁴	Wind	48 ²	47 ³	64	52-56 ⁴	Water, birds
¹ 24-hour measurement sites. ² L _D calculated from two 15-minute samples obtained from 7 a.m.-10 p.m. ³ L _N calculated from one 15-minute sample obtained from 10 p.m.-7 a.m. ⁴ L _{dn} estimated from L _D and L _N .											

Table 1. Summary of the results of the 1998-1999 survey of the distribution of the common carp (<i>Cyprinus carpio</i>) in the River Great Ouse, Bedfordshire.									
Station	Number of fish	Number of males	Number of females	Number of young	Number of juveniles	Number of adults	Number of old adults	Number of very old adults	Number of total fish
1. Bedford	10	5	5	0	0	0	0	0	10
2. Luton	15	8	7	0	0	0	0	0	15
3. Dunstable	20	10	10	0	0	0	0	0	20
4. Luton	12	6	6	0	0	0	0	0	12
5. Luton	18	9	9	0	0	0	0	0	18
6. Luton	14	7	7	0	0	0	0	0	14
7. Luton	16	8	8	0	0	0	0	0	16
8. Luton	11	6	5	0	0	0	0	0	11
9. Luton	13	7	6	0	0	0	0	0	13
10. Luton	17	9	8	0	0	0	0	0	17
11. Luton	19	10	9	0	0	0	0	0	19
12. Luton	16	8	8	0	0	0	0	0	16
13. Luton	14	7	7	0	0	0	0	0	14
14. Luton	15	8	7	0	0	0	0	0	15
15. Luton	17	9	8	0	0	0	0	0	17
16. Luton	18	10	8	0	0	0	0	0	18
17. Luton	19	11	8	0	0	0	0	0	19
18. Luton	20	12	8	0	0	0	0	0	20
19. Luton	21	13	8	0	0	0	0	0	21
20. Luton	22	14	8	0	0	0	0	0	22
21. Luton	23	15	8	0	0	0	0	0	23
22. Luton	24	16	8	0	0	0	0	0	24
23. Luton	25	17	8	0	0	0	0	0	25
24. Luton	26	18	8	0	0	0	0	0	26
25. Luton	27	19	8	0	0	0	0	0	27
26. Luton	28	20	8	0	0	0	0	0	28
27. Luton	29	21	8	0	0	0	0	0	29
28. Luton	30	22	8	0	0	0	0	0	30
29. Luton	31	23	8	0	0	0	0	0	31
30. Luton	32	24	8	0	0	0	0	0	32
31. Luton	33	25	8	0	0	0	0	0	33
32. Luton	34	26	8	0	0	0	0	0	34
33. Luton	35	27	8	0	0	0	0	0	35
34. Luton	36	28	8	0	0	0	0	0	36
35. Luton	37	29	8	0	0	0	0	0	37
36. Luton	38	30	8	0	0	0	0	0	38
37. Luton	39	31	8	0	0	0	0	0	39
38. Luton	40	32	8	0	0	0	0	0	40
39. Luton	41	33	8	0	0	0	0	0	41
40. Luton	42	34	8	0	0	0	0	0	42
41. Luton	43	35	8	0	0	0	0	0	43
42. Luton	44	36	8	0	0	0	0	0	44
43. Luton	45	37	8	0	0	0	0	0	45
44. Luton	46	38	8	0	0	0	0	0	46
45. Luton	47	39	8	0	0	0	0	0	47
46. Luton	48	40	8	0	0	0	0	0	48
47. Luton	49	41	8	0	0	0	0	0	49
48. Luton	50	42	8	0	0	0	0	0	50
49. Luton	51	43	8	0	0	0	0	0	51
50. Luton	52	44	8	0	0	0	0	0	52
51. Luton	53	45	8	0	0	0	0	0	53
52. Luton	54	46	8	0	0	0	0	0	54
53. Luton	55	47	8	0	0	0	0	0	55
54. Luton	56	48	8	0	0	0	0	0	56
55. Luton	57	49	8	0	0	0	0	0	57
56. Luton	58	50	8	0	0	0	0	0	58
57. Luton	59	51	8	0	0	0	0	0	59
58. Luton	60	52	8	0	0	0	0	0	60
59. Luton	61	53	8	0	0	0	0	0	61
60. Luton	62	54	8	0	0	0	0	0	62
61. Luton	63	55	8	0	0	0	0	0	63
62. Luton	64	56	8	0	0	0	0	0	64
63. Luton	65	57	8	0	0	0	0	0	65
64. Luton	66	58	8	0	0	0	0	0	66
65. Luton	67	59	8	0	0	0	0	0	67
66. Luton	68	60	8	0	0	0	0	0	68
67. Luton	69	61	8	0	0	0	0	0	69
68. Luton	70	62	8	0	0	0	0	0	70
69. Luton	71	63	8	0	0	0	0	0	71
70. Luton	72	64	8	0	0	0	0	0	72
71. Luton	73	65	8	0	0	0	0	0	73
72. Luton	74	66	8	0	0	0	0	0	74
73. Luton	75	67	8	0	0	0	0	0	75
74. Luton	76	68	8	0	0	0	0	0	76
75. Luton	77	69	8	0	0	0	0	0	77
76. Luton	78	70	8	0	0	0	0	0	78
77. Luton	79	71	8	0	0	0	0	0	79
78. Luton	80	72	8	0	0	0	0	0	80
79. Luton	81	73	8	0	0	0	0	0	81
80. Luton	82	74	8	0	0	0	0	0	82
81. Luton	83	75	8	0	0	0	0	0	83
82. Luton	84	76	8	0	0	0	0	0	84
83. Luton	85	77	8	0	0	0	0	0	85
84. Luton	86	78	8	0	0	0	0	0	86
85. Luton	87	79	8	0	0	0	0	0	87
86. Luton	88	80	8	0	0	0	0	0	88
87. Luton	89	81	8	0	0	0	0	0	89
88. Luton	90	82	8	0	0	0	0	0	90
89. Luton	91	83	8	0	0	0	0	0	91
90. Luton	92	84	8	0	0	0	0	0	92
91. Luton	93	85	8	0	0	0	0	0	93
92. Luton	94	86	8	0	0	0	0	0	94
93. Luton	95	87	8	0	0	0	0	0	95
94. Luton	96	88	8	0	0	0	0	0	96
95. Luton	97	89	8	0	0	0	0	0	97
96. Luton	98	90	8	0	0	0	0	0	98
97. Luton	99	91	8	0	0	0	0	0	99
98. Luton	100	92	8	0	0	0	0	0	100
99. Luton	101	93	8	0	0	0	0	0	101
100. Luton	102	94	8	0	0	0	0	0	102
101. Luton	103	95	8	0	0	0	0	0	103
102. Luton	104	96	8	0	0	0	0	0	104
103. Luton	105	97	8	0	0	0	0	0	105
104. Luton	106	98	8	0	0	0	0	0	106
105. Luton	107	99	8	0	0	0	0	0	107
106. Luton	108	100	8	0	0	0	0	0	108
107. Luton	109	101	8	0	0	0	0	0	109
108. Luton	110	102	8	0	0	0	0	0	110
109. Luton	111	103	8	0	0	0	0	0	111
110. Luton	112	104	8	0	0	0	0	0	112
111. Luton	113	105	8	0	0	0	0	0	113
112. Luton	114	106	8	0	0	0	0	0	114
113. Luton	115	107	8	0	0	0	0	0	115
114. Luton	116	108	8	0	0	0	0	0	116
115. Luton	117	109	8	0	0	0	0	0	117
116. Luton	118	110	8	0	0	0	0	0	118
117. Luton	119	111	8	0	0	0	0	0	119
118. Luton	120	112	8	0	0	0	0	0	120
119. Luton	121	113	8	0	0	0	0	0	121
120. Luton	122	114	8	0	0	0	0	0	122
121. Luton	123	115	8	0	0	0	0	0	123
122. Luton	124	116	8	0	0	0	0	0	124
123. Luton	125	117	8	0	0	0	0	0	125
124. Luton	126	118	8	0	0	0	0	0	126
125. Luton	127	119	8	0	0	0	0	0	127
126. Luton	128	120	8	0	0	0	0	0	128
127. Luton	129	121	8	0	0	0	0	0	129
128. Luton	130	122	8	0	0	0	0	0	130
129. Luton	131	123	8	0	0	0	0	0	131
130. Luton	132	124	8	0	0	0	0	0	132
131. Luton	133	125	8	0	0	0	0	0	133
132. Luton	134	126	8	0	0	0	0	0	134
133. Luton	135	127	8	0	0	0	0	0	135
134. Luton	136	128	8	0	0	0	0	0	136
135. Luton	137	129	8	0	0	0	0	0	137
136. Luton	138	130	8	0	0	0	0	0	138
137. Luton	139	131	8	0	0	0	0	0	139
138. Luton	140	132	8	0	0	0	0	0	140
139. Luton	141	133	8	0	0	0	0	0	141
140. Luton	142	134	8	0	0	0	0	0	142
141. Luton	143	135	8	0	0	0	0	0	143
142. Luton	144	136	8	0	0	0	0	0	144
143. Luton	145	137	8	0	0	0	0	0	145
144. Luton	146	138	8	0	0	0	0	0	146
145. Luton	147	139	8	0	0	0	0	0	147
146. Luton	148	140	8	0	0	0	0	0	148
147. Luton	149	141	8	0	0	0	0	0	149
148. Luton	150	142	8	0	0	0	0	0	150
149. Luton	151	143	8	0	0	0	0	0	151
150. Luton	152	144	8	0	0	0	0	0	152
151. Luton	153	145	8	0	0	0	0	0	153
152. Luton	154	146	8	0	0	0	0	0	154
153. Luton	155	147	8	0	0	0	0	0	155
154. Luton	156	148	8	0	0	0	0	0	156
155. Luton	157	149	8	0	0	0	0	0	157
156. Luton	158	150	8	0	0	0	0	0	158
157. Luton	159	151	8	0	0	0	0	0	159
158. Luton	160	152	8	0	0	0	0	0	160
159. Luton	161	153	8	0	0	0	0	0	161
160. Luton	162	154	8	0	0	0	0	0	162
161. Luton	163	155	8	0	0	0	0	0	163
162. Luton	164	156	8	0	0	0	0	0	164
163. Luton	165	157	8	0	0	0	0	0	165

CHAPTER FOUR

GOALS AND POLICIES

4.1 Goals

The goals of the Town of Mammoth Lakes Noise Element are:

- 1. To protect the citizens of the Town from the harmful and annoying effects of exposure to excessive noise.*
- 2. To protect the economic base of the Town by preventing incompatible land uses from encroaching upon existing or planned noise-producing uses.*
- 3. To preserve the tranquility of residential areas by preventing noise-producing uses from encroaching upon existing or planned noise-sensitive uses.*
- 4. To educate the citizens of the Town concerning the effects of exposure to excessive noise and the methods available for minimizing such exposure.*

4.2 Policies

The following specific policies have been adopted by the Town of Mammoth Lakes to accomplish the goals of the Noise Element:

Prevention of Adverse Noise Impacts due to Transportation Noise Sources:

- Policy 4.2.1** New development of noise-sensitive land uses shall not be permitted in areas exposed to existing or projected future levels of noise from transportation noise sources which exceed 60 dB L_{dn} in outdoor activity areas or 45 dB L_{dn} in interior spaces.
- Policy 4.2.2** Noise created by new transportation noise sources, including roadway improvement projects, shall be mitigated so as not to exceed 60 dB L_{dn} within outdoor activity areas and 45 dB L_{dn} within interior spaces of existing noise-sensitive land uses.

Introduction

1.1

The purpose of this report is to provide a detailed analysis of the data collected during the experiment.

2.1.1 The first part of the report describes the experimental setup and the data collection process.

2.1.2 The second part of the report discusses the results of the experiment and compares them with the theoretical predictions.

2.1.3 The third part of the report presents the conclusions of the experiment and discusses the implications of the results.

2.1.4 The final part of the report provides a summary of the findings and suggests directions for future research.

1.2

The following table shows the results of the experiment for different values of the parameter α .

Table 1: Results of the experiment for different values of α .

Table 2: Comparison of the experimental results with the theoretical predictions.

Table 3: Summary of the findings and suggestions for future research.

Table 4: Detailed analysis of the data for different values of α .

Table 5: Conclusions of the experiment and implications of the results.

Prevention of Adverse Noise Impacts due to Stationary Noise Sources:

Policy 4.2.3 New development of noise-sensitive land uses shall not be permitted where the noise level from existing stationary noise sources exceeds the noise level standards of Table VII.

Policy 4.2.4 Noise created by new proposed stationary noise sources or existing stationary noise sources which undergo modifications that may increase noise levels shall be mitigated so as not to exceed the noise level standards of Table VII at noise-sensitive uses.

TABLE VII

MAXIMUM ALLOWABLE NOISE EXPOSURE-STATIONARY NOISE SOURCES¹

	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly L_{eq} , dB	50	45
Maximum level, dB	70	65

¹As determined at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards may be applied on the receptor side of noise barriers or other property line noise mitigation measures.

Control of Existing Noise Nuisances:

Policy 4.2.5 The provisions of the existing noise ordinance of the Town of Mammoth Lakes (Chapter 8.16 of the Municipal Code) should be consistent with the goals and policies of the Noise Element, and be appropriate for the specific needs of the Town.

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CONTENTS	
Original Articles	1-10
Editorial	11-12
Book Reviews	13-14
Correspondence	15-16
Obituary	17-18
Announcements	19-20
Index	21-22

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CHAPTER FIVE

IMPLEMENTATION MEASURES

To achieve compliance with the policies of the Noise Element, the Town of Mammoth Lakes shall undertake the following implementation program. The implementation program focuses on the prevention of new noise-related land use conflicts by requiring that new development be reviewed to determine whether it complies with the policies in Chapter 3.

- 5.1 The Town shall review new public and private development proposals to determine conformance with the policies of this Noise Element.
- 5.2 The Town shall require an acoustical analysis in those cases where a project potentially threatens to expose noise-sensitive land uses to excessive noise levels. The presumption of excessive noise levels shall be based on the location of new noise-sensitive uses to known noise sources (see Table I and Noise Contour Maps on file with the Town of Mammoth Lakes), or staff's professional judgement that a potential for adverse noise impacts exists. Acoustical analyses shall be required early in the review process so that noise mitigation may be included in the project design. For development not subject to environmental review, the requirements for an acoustical analysis shall be implemented prior to the issuance of building permits. The requirements for the content of an acoustical analysis are given in Appendix B.
- 5.3 The Town shall develop and employ procedures to ensure that noise mitigation measures required pursuant to an acoustical analysis are implemented in the development review and building permit processes.
- 5.4 The Town shall develop and employ procedures to monitor compliance with the policies of the Noise Element after completion of projects where noise mitigation measures have been required.
- 5.5 The Town shall enforce the State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code (UBC) concerning interior noise exposure for multi-family housing, hotels and motels.

THEORY OF THE EARTH

The first part of the book is devoted to a general discussion of the theory of the earth, and the second part to a more detailed treatment of the various branches of the subject.

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- 5.6 The Town shall request the California Highway Patrol, the sheriff's office and the police department to actively enforce the California Vehicle Code sections relating to adequate vehicle mufflers and modified exhaust systems.
- 5.7 The Town shall periodically review and update the Noise Element to ensure that noise exposure information and specific policies are consistent with changing conditions within the Town and with noise control regulations or policies enacted after the adoption of this element.
- 5.8 The Town shall revise its noise ordinance so that its noise limits are consistent with those of the Noise Element, the language of the noise ordinance is clear and concise, and that potential noise nuisances that are unique to the Town, such as snow making equipment, are appropriately regulated.

The first part of the report, which is the most important, is the one that deals with the results of the experiments. It is here that the reader can find out what the researchers have discovered and what conclusions they have drawn from their work.

The second part of the report is the one that deals with the methods used in the experiments. This part is important because it allows the reader to see how the experiments were conducted and to evaluate the reliability of the results.

The third part of the report is the one that deals with the discussion of the results. This part is important because it allows the reader to see how the researchers interpret their results and what they think about the implications of their findings.

APPENDIX A

NOISE AND ITS EFFECTS ON PEOPLE

Fundamentals of Noise Assessment:

Noise is often defined simply as unwanted sound, and thus is a subjective reaction to characteristics of a physical phenomenon. The descriptors of community noise in current use are the results of many years of effort to translate objective measurements of sound into measures of subjective reaction to noise. Before elaborating on these descriptors, it is useful to discuss some fundamental concepts of sound.

Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and hence are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, now called Hertz (Hz) by international agreement.

The speed of sound in air is approximately 770 miles per hour, or 1,130 feet/second. Knowing the speed and frequency of a sound, one may calculate its wavelength, the physical distance in air from one compression of the atmosphere to the next. An understanding of wavelength is useful in evaluating the effectiveness of physical noise control devices such as mufflers or barriers, which depend upon either absorbing or blocking sound waves to reduce sound levels.

To measure sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel (dB) scale was devised.

The decibel scale uses the hearing threshold as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. Use of the decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. In the range of usual environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighting the frequency response

THE 1998 CONVENTION ON THE PROTECTION OF THE RIGHTS OF THE CHILD

ARTICLE 1: DEFINITION OF A CHILD

For the purposes of the Convention, a child means every human being below the age of eighteen years unless, under the law applicable to the child, majority is attained earlier.

The Convention shall be applied to all children without distinction of race, religion, or social origin.

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of a sound level measurement device (called a sound level meter) by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. Figure A-1 illustrates typical A-weighted sound levels due to recognizable sources.

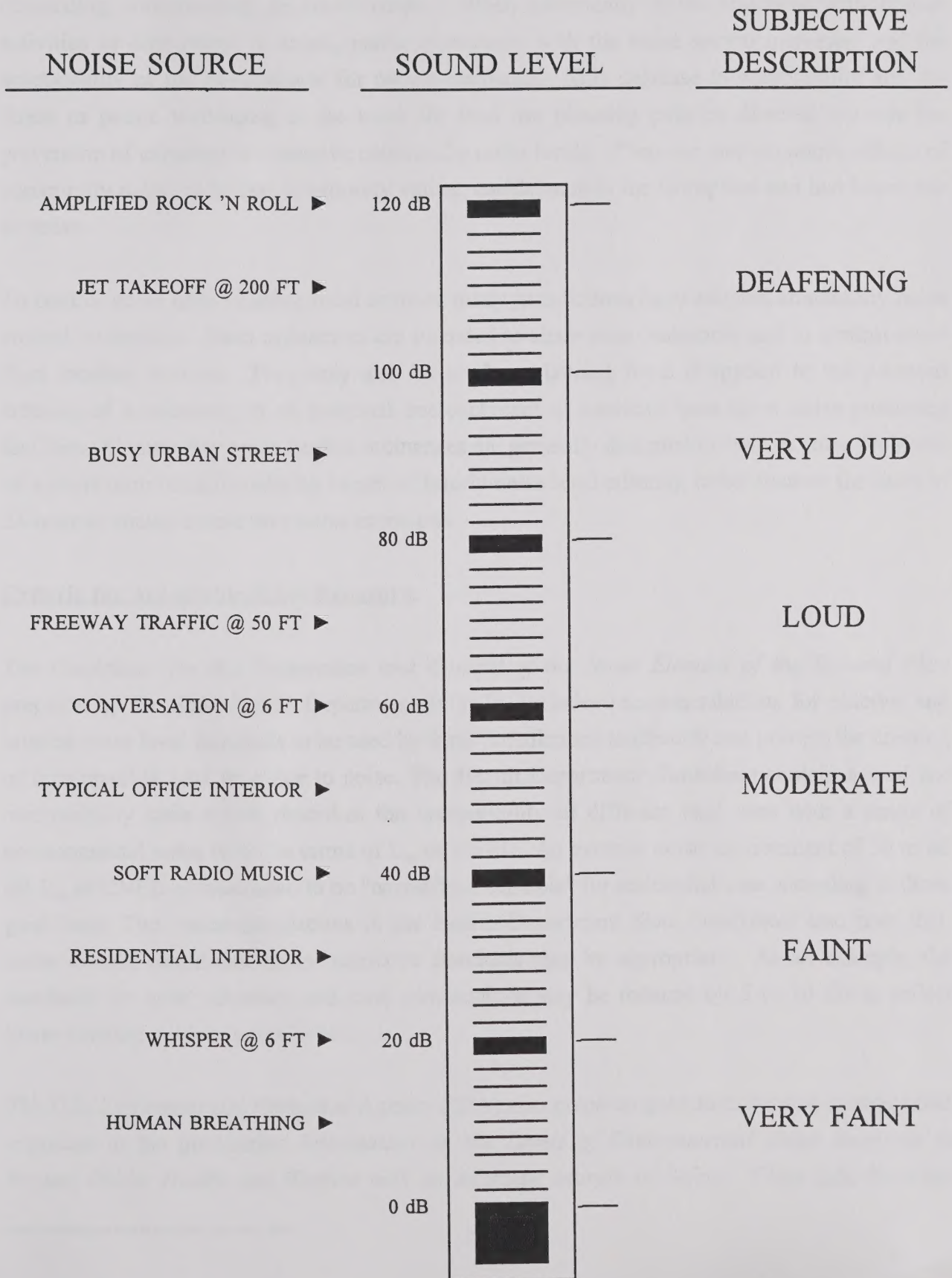
It is common to describe community noise in terms of the "ambient" noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}), which is the sound level corresponding to a steady-state A-weighted sound level containing the same total energy as a time-varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptors such as L_{dn} and CNEL, and shows very good correlation with community response to noise.

Two composite noise descriptors are in common use today: L_{dn} and CNEL. The L_{dn} (day-night average level) is based upon the average hourly L_{eq} over a 24-hour day, with a +10 decibel weighting applied to nighttime (10:00 p.m. to 7:00 a.m.) L_{eq} values. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were subjectively twice as loud as daytime exposures. The CNEL (Community Noise Equivalent Level), like L_{dn} , is also based upon the weighted average hourly L_{eq} over a 24-hour day, except that an additional 4.77 decibel penalty is applied to evening (7:00 p.m. to 10:00 p.m.) hourly L_{eq} values.

The CNEL was developed for the California Airport Noise Regulations, and is applied specifically to airport/aircraft noise assessment. The L_{dn} scale is a simplification of the CNEL concept, but the two will usually agree, for a given situation, within 1 dB. Like the L_{eq} , these descriptors are also averages and tend to disguise variations in the noise environment. Because L_{dn} and CNEL presume increased evening or nighttime sensitivity, they are best applied as criteria for land uses where nighttime noise exposures are critical to the acceptability of the noise environment, such as residential developments.

figure A-1 EXAMPLES OF NOISE LEVELS

EXAMPLES OF SOUND LEVELS



Noise in the community has often been cited as being a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from the interference with human activities such as sleep, speech, recreation, and tasks demanding concentration or coordination. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases, and the acceptability of the environment for people decreases. This decrease in acceptability and the threat to public well-being is the basis for land use planning policies directed towards the prevention of exposure to excessive community noise levels. There are also economic affects of community noise: reduction in property values, inefficiency in the workplace and lost hours due to stress.

To control noise from existing fixed sources, many jurisdictions have adopted community noise control ordinances. Such ordinances are intended to abate noise nuisances and to control noise from existing sources. They may also be used as planning tools if applied to the potential creation of a nuisance, or to potential encroachment of sensitive uses upon noise-producing facilities. Community noise control ordinances are generally designed to resolve noise problems on a short-term basis (usually by means of hourly noise level criteria), rather than on the basis of 24-hour or annual cumulative noise exposures.

Criteria for Acceptable Noise Exposure:

The *Guidelines for the Preparation and Content of the Noise Element of the General Plan* prepared by the State Health Department in 1976, includes recommendations for exterior and interior noise level standards to be used by local jurisdictions to identify and prevent the creation of incompatible land uses due to noise. The Health Department *Guidelines* contain a land use compatibility table which describes the compatibility of different land uses with a range of environmental noise levels in terms of L_{dn} or CNEL. An exterior noise environment of 50 to 60 dB L_{dn} or CNEL is considered to be "normally acceptable" for residential uses according to those guidelines. The recommendations in the Health Department *State Guidelines* also note that, under certain conditions, more restrictive standards may be appropriate. As an example, the standards for quiet suburban and rural communities may be reduced by 5 to 10 dB to reflect lower existing outdoor noise levels.

The U.S. Environmental Protection Agency (EPA) also prepared guidelines for community noise exposure in the publication *Information on the Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. These guidelines are

based upon assumptions regarding acceptable noise levels which consider occupational noise exposure as well as noise exposure in the home. The guidelines recognize an exterior noise level of 55 dB L_{dn} as a goal to protect the public from hearing loss, activity interference, sleep disturbance and annoyance. The EPA notes, however, that this level is not a regulatory goal, but is a level defined by a negotiated scientific consensus without concern for economic and technological feasibility or the needs and desires of any particular community. The EPA and other governmental agencies have adopted suggested land use compatibility guidelines which indicate that residential noise exposures of 55 to 65 dB L_{dn} are within acceptable limits.

For control of noise nuisances, a community noise control ordinance is the most appropriate tool. The State Health Department has prepared a *Model Community Noise Control Ordinance* which contains recommended noise standards in terms of "time-weighted" sound levels. The time-weighting concept allows discrimination of both short- and long-term noise exposures, and sets allowable levels for each. The *Model* recommends more stringent standards for residential land uses than for commercial and industrial, with the most stringent standards recommended for "rural suburban" situations. The primary exterior noise standard for rural residential uses is 50 dB in the daytime hours (7 a.m. to 10 p.m.), and 40 dB at night. The standard is expressed in terms of the level exceeded for 30 minutes of an hour, equivalent to the median level, or L_{50} . This ordinance format is successfully applied in many California cities and counties.

In addition to the A-weighted noise level, other factors should be considered in establishing criteria for noise sensitive land uses. For example, sounds with noticeable tonal content such as whistles, horns, or droning or high-pitched sounds may be more annoying than the A-weighted sound level alone will suggest. Many noise standards apply a penalty, or correction, of 5 dB to such sounds. The effects of unusual tonal content will generally be more of a concern at nighttime, when residents may notice the sound in contrast to previously-experienced background noise.

Because many rural residential areas experience very low noise levels, residents may express concern about the loss of "peace and quiet" due to the introduction of a sound which was not audible previously. In very quiet environments, the introduction of virtually any change in local activities will cause an increase in noise levels. A change in noise level and the relative loss of "peace and quiet" is the inevitable result of land use or activity changes in such areas. Audibility of a new noise source and/or increases in noise levels within recognized acceptable limits are not usually considered to be significant noise impacts, but these concerns should be addressed and considered in the planning and environmental review processes.

There is a great deal of interest in the study of the human mind, and it is a subject which has attracted the attention of philosophers, scientists, and the general public. The study of the mind is a complex task, and it is one which has been approached in many different ways. Some have tried to understand the mind by studying the behavior of the individual, while others have tried to understand it by studying the physical structure of the brain. The study of the mind is a subject which is still in its infancy, and it is one which is sure to attract the attention of future generations.

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Table A-1 is commonly used to show expected public reaction to changes in environmental noise levels. This table was developed on the basis of test subjects' reactions to changes in the levels of steady-state pure tones or broad-band noise, or to changes in levels of a given noise source. It is probably most applicable to noise levels in the range of 50 to 70 dB, the usual range of voice and interior noise levels. It is probably not directly applicable to public perception of identifiable intrusive noise sources in very quiet environments because of the difference in frequency content between background noise sources and intrusive sounds, as well as the fact that the absolute amount of energy required to make a given change in sound pressure level is much smaller at low noise levels than at higher levels. Table A-1 should therefore only be applied in a general manner to show the relationship between changes in sound energy, sound pressure levels and subjective reaction.

The comparisons of subjective reaction outlined in Table A-1 are not applicable to noise exposures which are very quiet or very loud. For example, a whisper which is increased by 10 decibels, e.g., from 20 dB to 30 dB, remains a whisper, and would still be described as quiet. In contrast, an increase in the noise level of a diesel locomotive from 90 dB to 100 dB would be a change from a loud noise to a very loud noise. Thus the subjective reaction to a 10 dB change in either case may be different, even though the change in level is the same.

TABLE A-1

SUBJECTIVE REACTION TO CHANGES IN NOISE LEVELS OF SIMILAR SOURCES

Increase in Sound Pressure Level, dB	Relative Increase in Acoustical Energy	Subjective Reaction
1	1.26 times	Minimum Detectable Change (Lab)
3	2.0 times	Usually Noticeable Change
5	3.2 times	Definitely Noticeable Change
10	10.0 times	Twice as Loud as Before

Sources: Various, reported by Brown-Buntin Associates, Inc.

APPENDIX B

REQUIREMENTS FOR AN ACOUSTICAL ANALYSIS

An acoustical analysis prepared pursuant to the Noise Element shall:

- A. Be the financial responsibility of the applicant.
- B. Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics.
- C. Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions and significant noise sources. Where actual field measurements cannot be conducted, all sources of information used for calculation purposes shall be fully described.
- D. Estimate existing and projected (20 years) noise levels and compare those levels to the adopted policies of the Noise Element. Projected future noise levels shall take into account noise from planned streets, highways and road connections.
- E. Recommend appropriate mitigation to achieve compliance with the adopted policies of the Noise Element, giving preference to proper site planning and design over mitigation measures which require the construction of noise barriers or structural modifications to buildings which contain noise-sensitive land uses.
- F. Estimate noise exposure after the prescribed mitigation measures have been implemented.



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PROCEEDINGS OF THE 1972 ANNUAL MEETING

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